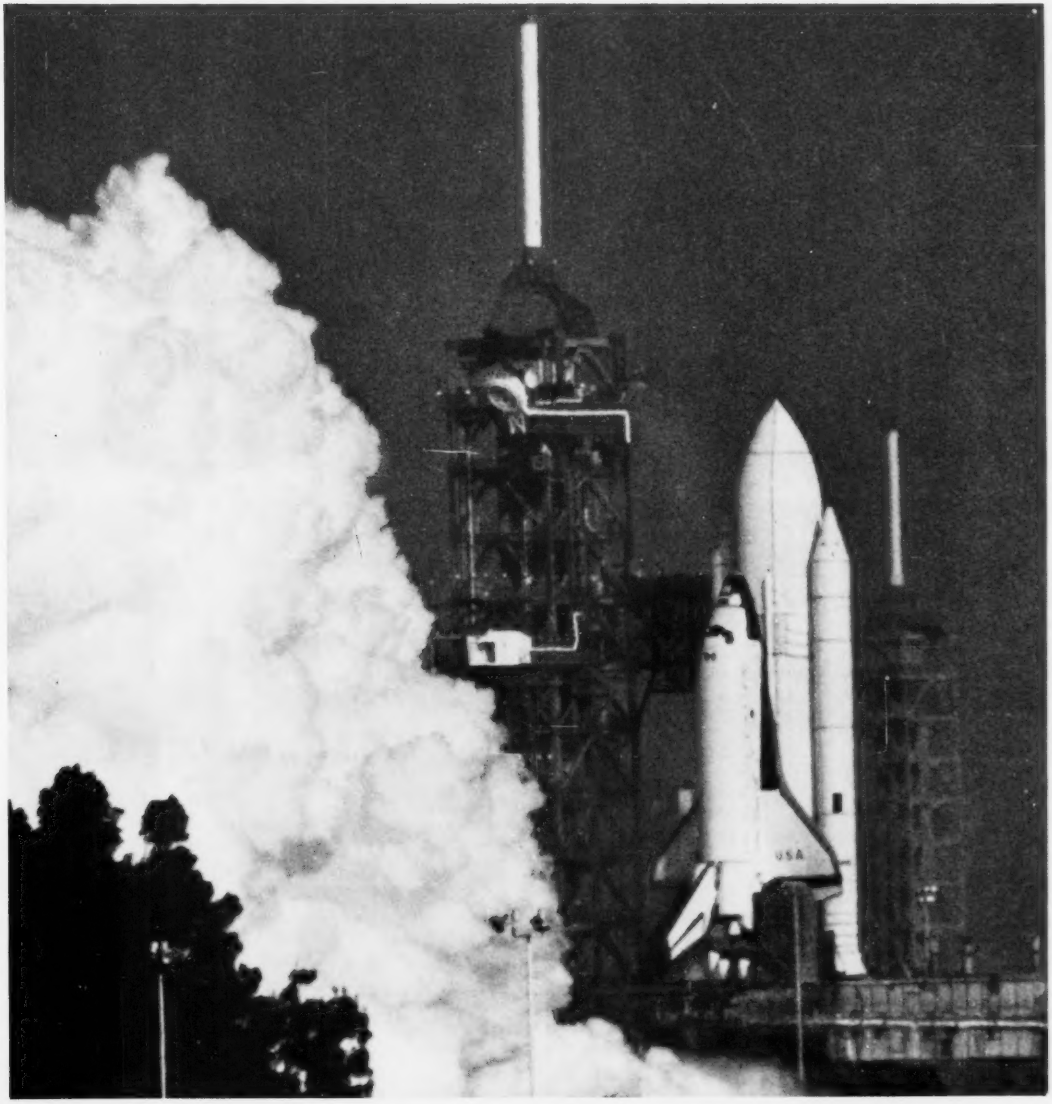
# NASA Activities

National
Aeronautics and
Space
Administration

**April 1981**
**Vol. 12, No. 4**



## COVER

**Shuttle Engines Ready**—The three main engines of the Space Shuttle *Columbia* were successfully test fired Feb. 20 for 20 seconds in the last major engine firing prior to launch in early April. The countdown and firing duplicated the events of an actual launch except that the shuttle crew was not in the cockpit and the solid rocket boosters were not fired. Richard G. Smith, Kennedy Space Center Director, and George F. Page, Launch Director, both said they were extremely pleased with the firing and the smoothness of the countdown.

## Table of Contents


Major Milestones to Launch ..... 3
Pioneer Suggests Venus Got Big Input From Sun 4
NASA Launches COMSTAR D-4 ..... 5
NASA, FAA, and Northwest Airlines Cooperate on Ozone Experiment ..... 6
New Aircraft to be Delivered for High Altitude Studies ..... 8
NASA Tests Older Women For Spaceflight Stress ..... 9
NASA Technology Brings Recycled Water Closer to Home ..... 9
NASA Engineers Developing Advanced Cooling System ..... 11
Selection Begun In Shuttle Student Project Competition ..... 11
Goddard Hosts Solar Flare Workshop ..... 12
Contractor News ..... 13
Did You Know? ..... 14
Expendable Launches for 1981 ..... 15
Space Shuttle Launches for 1981 ..... 15
Patents for Inventions ..... 15
Another Dividend from Air and Space ..... 16



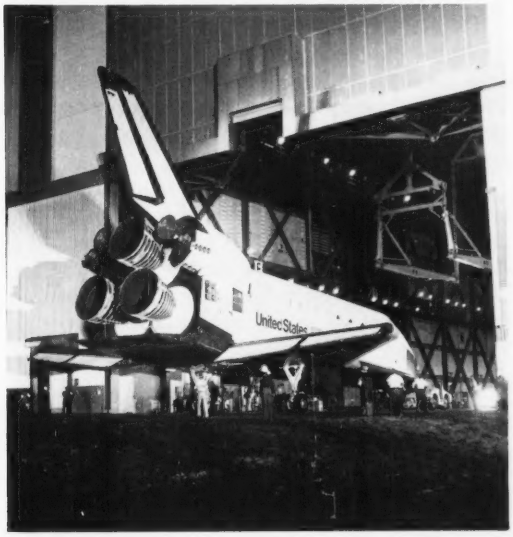
**NASA Activities** is published monthly by the National Aeronautics and Space Administration for the information of the Agency's employees.
Contributions and recommendations are solicited from headquarters and field centers, and should be addressed to the Office of Public Affairs, Code LFD-10, Washington, D.C. 20546.

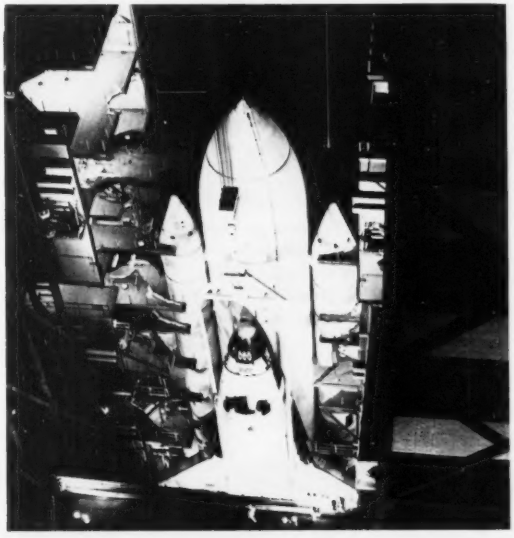
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Annual subscription rate: $14.50 domestic; $18.15 foreign. Price per single copy: $1.50 domestic, $1.90 foreign. Back issues not available.

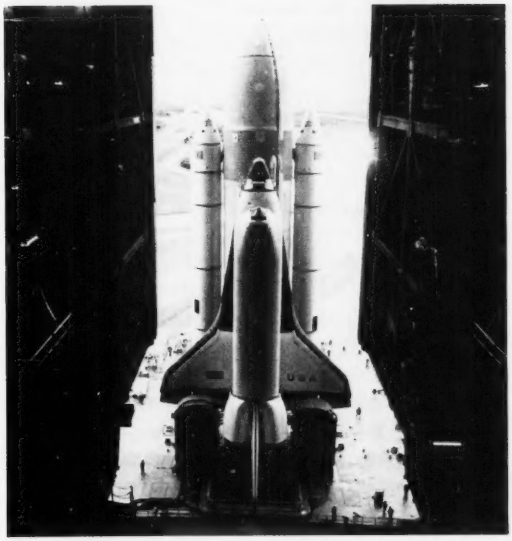
Keith McBee
Editor, Code LFD-10
NASA Headquarters, FOB 6
Washington, D.C. 20546
(Phone: (202) 755-8348)

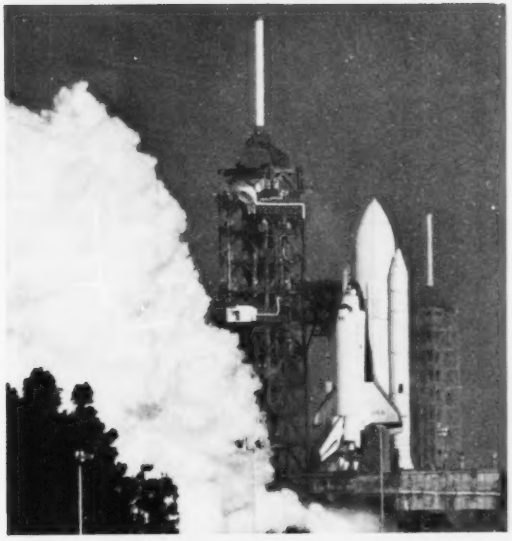
## Major Milestones to Launch

With the launch of the Space Shuttle *Columbia,* now scheduled for early April, a new era in space transportation and space utilization will have begun. Below are pictorial records of major events prior to launch. **Top left:** Roll over of the *Columbia* from the Orbiter Processing Facility to the Vehicle Assembly Building at Kennedy Space Center on Nov. 24, 1980; **top right:** the *Columbia* upright in the Vehicle Assembly Building, with the external tank and solid rocket boosters stacked and mated; **bottom left:** the rollout of the *Columbia* to Kennedy's launch pad 39A on Dec. 29, shown here as the spacecraft leaves the Vertical Assembly Building for the 3½-mile journey to the pad; **bottom right:** Flight Readiness Firing on Feb. 20, the last major test of the *Columbia*'s engines prior to launch.









Drawing of the Pioneer-Venus multiprobe spacecraft (top). The large probe descended the Venus atmosphere by parachute to an altitude of about 44 kilometers where it jettisoned the chute and then free-fell to the planet's surface. The small probes, each carrying five pounds of instrumentation, sampled the Venus weather at locations 5,000 miles apart. Their mission ended when they landed on the surface of the planet, about one hour after entry. Shown below is an artist's concept of the Pioneer-Venus probe entering the Venusian atmosphere.

## Pioneer Suggests Venus Got Big Input From Sun

Data from the Pioneer Venus probes suggests a far larger contribution by the Sun to Venus' atmosphere than was received by the Earth from the Sun during early evolution of the solar system.

Venus' atmosphere has far less of the noble gas krypton than might have been expected. The planet has less krypton than is found on the Sun and more than found on Earth.

The krypton measurements are the first ever made on the planet, and they appear to provide some basic evidence about the formation of the early solar system. They were made by the Pioneer Venus probe mass spectrometer as it descended through Venus' dense atmosphere on Dec. 9, 1978.

The determination of the amount of the krypton and an upper limit to the amount of xenon on the planet was announced by Dr. Thomas Donahue, University of Michigan. How the quantities of the two noble gases, krypton and xenon, can tell us about the formation of Venus' atmosphere is a solar system detective story, says Donahue.

Venus received a large input of various gases from the Sun in the early solar system, during a half-million-year period of much denser solar wind than today's, Donahue suggests. (This concept of enhanced solar wind contributing a large amount of rare gases to Venus was first proposed by Dr. George Wetherill, Director of the Carnegie Institution, Washington, D.C.)

This material which blew out from the forming Sun during this relatively short period would have impacted upon the mass of material condensing within Venus' orbit to become the planet. In its turn, the proto-Venus material would have blocked off the enriched solar wind, preventing it from blowing farther out to the then forming Earth and Mars. Hence, today's Earth is relatively deprived of the two gases krypton and xenon, as well as of other noble gases such as argon.

The theory is further strengthened by earlier Pioneer findings about the amount of primordial argon (argon 36) on Venus. Pioneer found that Venus has 75 times as much argon 36 in its atmosphere as the Earth has—a profound discovery.

The excess argon was discovered by the gas chromatograph experiment of Vance Oyama, Ames Research Center, Mountain View, Calif., and the mass spectrometer experiment of Dr. John Hoffman,

University of Texas, Dallas, who demonstrated that the excess was the argon-36 isotope.

Various theories have been proposed for Venus' large amount of primordial argon. These have suggested that the planet had an unusually efficient way of trapping noble gases like argon, krypton and xenon during its formation. (Noble gases usually will not combine chemically with other elements.) Therefore, scientists believed that, along with its argon, Venus would have something like 75 times as much krypton and xenon as the Earth. Instead, Dr. Donahue found from the Pioneer data that Venus has only about three times as much of these two gases as the Earth. (For various reasons, he was only able to set an upper limit for xenon—not more than 30 times the amount on Earth but probably much less.)

However, the most interesting thing, says Donahue, is not that Venus has three times as much krypton as Earth, but that the planet has 700 times as much primordial argon as it has krypton. This compares with an argon/krypton ratio for Earth and Mars of only 30 to 1. The reason this is so interesting is that the Sun has 2,000 times as much argon as krypton.

Since Venus has far more of all three of these gases than Earth, and has them in proportions more like those of the Sun than of the Earth, there is strong likelihood the gases came from the Sun. And this provides some real evidence about early formation of the solar system.

The Pioneer Venus orbiter spacecraft continues to return pictures and other data on Venus and its atmosphere, and is expected to produce data through 1985. The four Pioneer probe craft entered Venus' atmosphere in December 1978, providing the mass spectrometer data. The Pioneer project is managed by NASA's Ames Research Center, Mountain View, Calif.

## NASA Launches COMSTAR D-4

The fourth in the COMSTAR series of domestic communications satellites, was successfully launched on board an Atlas Centaur rocket on Feb. 21 at 6:23 EST, by NASA's Kennedy Space Center from the Cape Canaveral Air Force Station, Fla. The COMSTAR series is owned by the COMSAT General Corporation of Washington, D.C.

The 6.1-meter high, cylindrical satellite, weighing 1,516 kilograms at launch, carries 12 transponders, or channels, each capable of relaying 1,500 one-way voice circuits. This satellite has an overall communications capability of 18,000 simultaneous high quality, two-way telephone transmissions.

The launch of COMSTAR D-4, the fourth in a series of domestic communications satellites owned by COMSAT General Corp. The satellite was launched by NASA's Kennedy Space Center from Cape Canaveral Air Force Station on Feb. 21, at 6:23 EST.

COMSTAR D-4 is positioned in a geosynchronous orbit over the Pacific Ocean at 127 degrees west longitude providing communications services to major metropolitan areas of the continental United States and Hawaii.

COMSTAR satellites are built by the Hughes Aircraft Co., Culver City, Calif. Their entire communications capability is leased by COMSAT General to American Telephone and Telegraph which operates ground stations serving New York, Chicago, San Francisco and Atlanta. Three other COMSTAR ground stations, operated by GTE Satellite Corp., a subsidiary of General Telephone and Electronics, serve Tampa, Los Angeles and Hawaii.

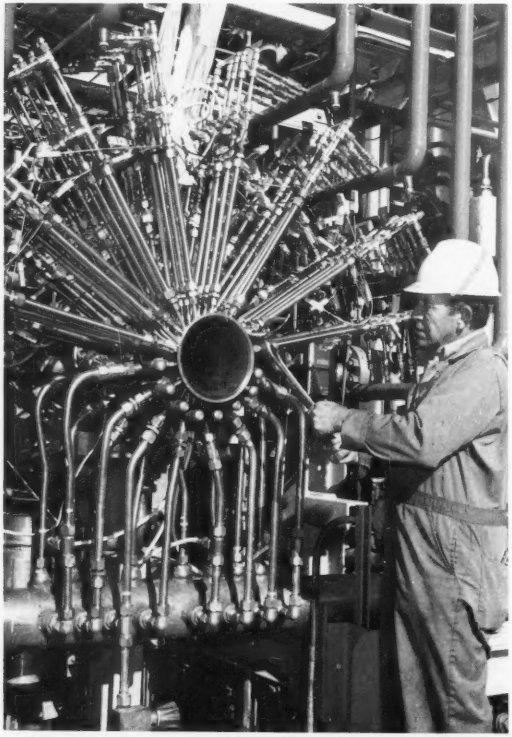
The Atlas Centaur launch vehicle placed the COMSTAR D-4 into a highly elliptical "transfer orbit" ranging from a low point of 547 kilometers to an apogee or high point of 35,788 km above the Earth.

After the satellite separated from the Centaur stage, the COMSAT Control Center in Washington, D.C., took over operational control. At about 48

hours after launch, the Centaur commanded the satellite's apogee kick motor to fire in order to circularize the orbit at geosynchronous altitude over the equator. At that altitude, because the speed of the satellite in orbit matches the rotational speed of the Earth, the satellite remains over one spot.

NASA's Lewis Research Center, Cleveland, has management responsibility for Atlas Centaur development and operation. The Kennedy Space Center, Fla., is assigned launch responsibility once the Atlas Centaur reaches Cape Canaveral.

Overall direction of the program is vested in the Office of Space Transportation Operations at NASA Headquarters, Washington, D.C. NASA is reimbursed by COMSAT General for the cost of the Atlas Centaur and related launch services.



**Model Thrust Chamber**—A technician tightens water lines which cool a model rocket engine thrust chamber used in engine research and technology development at NASA's Marshall Space Flight Center, Huntsville, Ala. These thrust chambers, measuring just over a foot long, produce about 40,000 pounds of thrust.

## NASA, FAA, and Northwest Airlines Cooperate on Ozone Experiment

A two-month experiment began March 2 in which information from NASA's Nimbus 7 satellite will assist U.S. airlines in determining atmospheric ozone concentration, jet stream patterns and clear air turbulence regions.

Scientists at NASA's Goddard Space Flight Center, Greenbelt, Md., and meteorologists with Northwest Airlines will conduct the experiment. If successful, the information could be used to avoid areas of high ozone concentrations and to save time and fuel on both domestic and international flights.

The joint NASA/Federal Aviation Administration/ Northwest Airlines experiment is to be conducted in accordance with a new FAA regulation, effective Feb. 20, that requires airlines to limit the ozone levels inside aircraft. The regulation stems from an increasing number of complaints on ozone-related symptoms, such as eye and throat irritation.

The new regulation allows airline operators to minimize ozone exposure by several methods: installing filters to remove ozone from air entering the cabin and planning flight routes which avoid areas of high ozone concentration. Currently, it is necessary to use statistical predictions of ozone concentrations because real-time ozone data is not available. The experiment is geared to the second alternative and will directly measure the geographic ozone distributions on a near real time basis. The FAA's Office of Environment and Energy has encouraged this experiment and has contributed funds to its support.

Ozone is a naturally produced gas that can be irritating and toxic, and forms a layer in the stratosphere between 10,700 and 46,000 meters above the Earth. Ozone concentrations are greatest in the polar latitudes, especially from late February to early May over the northern hemisphere, during which time pockets of ozone descend to 7,600 m. Cruising altitudes of today's jetliners vary, but on longer flights, they are normally at and above 10,700 meters. Long-range international flights fly to a height of 13,700 meters, and the Concorde goes as high as 16,700 meters. Ozone serves a useful purpose by absorbing the Sun's harmful ultraviolet radiation.

NASA's Nimbus 7 spacecraft, launched Oct. 24, 1978, was the first satellite designed to monitor the Earth's atmosphere for man-made and natural pollutants. At the time, there was great national concern that fluorocarbons, the man-made chemicals

found in spray cans and some refrigerants, were drifting into the stratosphere and slowly destroying the Earth's protective layer of ozone.

While the spacecraft's instruments have been highly successful in recording those effects, early computer-enhanced pictures from the satellite's Total Ozone Mapping Spectrometer provided clear evidence that there are significant commercial advantages to be gained from these observations as well.

The first pictures from the ozone spectrometer showed a distinctly patchy pattern in the ozone concentration in the lower stratosphere. In studying the pictures, Arlin J. Krueger, the spectrometer sensor scientist at Goddard where the satellite information is processed, also discovered that there was a high correspondence between the ozone concentrations and high and low stratospheric pressure areas that establish the flow of the jet streams. Consultation with Dr. Melvyn Shapiro of the National Center for Atmospheric Research in Boulder, Colo., and with other meteorologists supported his findings.

Further evaluation by Daniel Sowa, Chief Meteorologist with Northwest Airlines, indicated that "there is an excellent correlation between the high concentrations of ozone shown on the spectrometer charts and the atmospheric synoptic weather patterns." Sowa also feels that the spectrometer data "can be used to identify areas of clear air turbulence associated with the jet stream." Flight in

**Deep Space Control Center**—The Jet Propulsion Laboratory's Deep Space Network communicates with and tracks automated scientific spacecraft traveling in deep space. Shown is the JPL control center of the Network, which manages receipt of engineering and science telemetry from spacecraft and directs transmission of commands for spacecraft operations. The Jet Propulsion Laboratory, Pasadena, Calif., operates the Deep Space Network for NASA.

clear air turbulence can produce a bumpy, discomforting ride and disturb the controllability of the airplane.

In the experiment, observations from the spacecraft will be obtained at Goddard and relayed to meteorologists with Northwest Airlines in Minneapolis. Using the information, the meteorologists are expected to determine if it is feasible to predict on a real-time basis high ozone locations so that high-altitude flying aircraft can avoid the ozone exposure.

They also hope to identify more accurately the areas of clear air turbulence associated with jet streams. Flying into a jet stream is the equivalent of trying to swim upstream. It causes a major reduction in an aircraft's ground speed, lengthens flight time, and increases fuel consumption. By the same token, if a plane can take advantage of the jet stream as a tailwind, ground speeds can be increased—in some cases, more than 160 kilometers an hour, which shaves flight time and greatly reduces fuel consumption.

With increased fuel prices in today's energy crisis, lower fuel consumption is a major concern of airlines. NASA scientists have indicated that if precise locations of the jet streams can be determined, airlines might realize a significant reduction in their fuel consumption. Estimates hold that the worldwide outlay for aviation fuel is between $30 and $40 billion, with about one-third consumed in the United States.

## New Aircraft to be Delivered For High Altitude Studies

A new high altitude aircraft designed to carry nearly two tons of instruments 21 kilometers high is scheduled for delivery to NASA's Ames Research Center, Mountain View, Calif., in April by the Lockheed-California Company.

Designated the NASA ER-2 (for Earth Resources) aircraft, it will augment research programs being carried out by two Lockheed U-2 aircraft now at Ames.

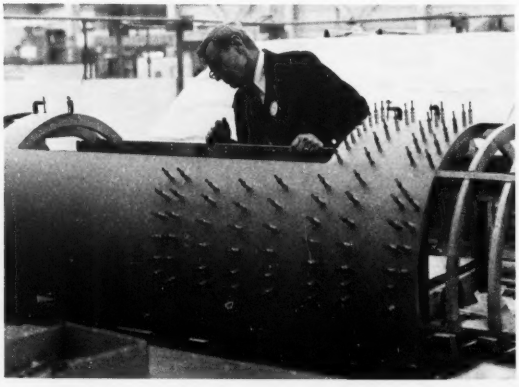
The ER-2 is similar to the U-2 but is larger and has a greater payload, range and altitude capability. It is a one-place single-engine jet aircraft designed to cruise as high as 21,600 meters at a speed of 770 kilometers per hour for as long as 12 hours.

Payload compartments in the aircraft's nose section, a section behind the pilot, and in wing pods, will be capable of carrying a variety of cameras, and imaging radar and other sensors for scientific measurements and Earth resources studies.

The aircraft is being assembled at Lockheed's Palmdale, Calif., facility and will cost about $13 million including $2 million for spare components. It is expected to be in service for at least as long as U-2 aircraft at NASA—some 20 years.

Based at Ames Research Center, the ER-2 will be employed on NASA missions under the direction of the Applications Systems Program of the Office of Space and Terrestrial Applications at NASA Headquarters, Washington, D.C.

Artist's depiction of the new ER-2 aircraft. The ER-2 will fly higher and farther with triple the payload carried by its sister ships, two Lockheed U-2's now used for Earth resources studies by NASA Ames.



Shown in final fabrication phase is one of two payload carriers called "superpods" for NASA's new ER-2 (for Earth Resources) aircraft. Projections on the superpod are Cleco fasteners holding the skin in place for riveting. The superpods, mounted on the wings of the ER-2, increase the scientific payload capacity of the aircraft by about 50 percent of the internal payload.

**Awaiting FRF**—Representatives of foreign and domestic news organizations, publications and television networks gathered at the Kennedy Space Center's Press Center for a briefing on the Flight Readiness Firing, (FRF), a 20-second test "burn" on Orbiter Columbia's main engines. The Feb. 20th firing was a complete success and marked the last major engine test prior to launch in early April.

## NASA Tests Older Women For Spaceflight Stress

NASA's Ames Research Center, Mountain View, Calif., recently tested women 55 to 65 years old to find out if they could withstand the physiological stress of weightlessness.

The eight test subjects, selected from more than 200 volunteers, were the oldest women NASA has subjected to prolonged bedrest, which closely simulates the effects of weightlessness.

The study concluded a series of six experiments designed to establish baseline medical criteria for Space Shuttle participation.

At Ames last April, eight men aged 55 to 65 became the oldest humans ever tested for response to simulated weightlessness. The other four studies involved males and females aged 35 to 45 and 45 to 55.

Eighty-five women volunteers reported for personal interviews. About 40 were asked to attend a briefing and take a physical examination. Twenty women then were chosen to participate in a preliminary orientation and testing period March 16 to 27. The preliminary study gave Dr. Harold Sandler, project scientist, an opportunity to see how subjects perform on tests and also helped the subjects decide whether they wanted to participate.

Of the eight subjects selected, four were admitted April 1 to the Ames Human Research Facility for nine days of controlled observations and tests, 10 days of bedrest and five days of recovery and post-bedrest tests of the cardiovascular system. The other four subjects were admitted April 4 for the same 24-day sequence of events.

Sandler has 12 co-investigators, nine associated with Ames, one at NASA's Johnson Space Center in Houston, one at Stanford University and one at the New Jersey Medical School. The Ames Human Research Facility is managed by Dee O'Hara, R.N.

## NASA Technology Brings Recycled Water Closer To Home

In an experimental waste-water treatment plant in Palo Alto, Calif., NASA has been working with the Santa Clara Valley Water District, the EPA and the California Department of Water Resources using a system of automatic water-quality monitoring that is quick, efficient and requires almost no human intervention.

Although the recycled water is not piped into homes, it is clean enough to be returned to the San Francisco Bay without harm to sea life. And, according to NASA project manager Ken Nishioka, the water may be "cleaner than tap water," but studies still must be done to determine the long-term effects, if any, of drinking it.

Automated water-quality monitoring, defined as the ability to obtain desired water-quality data without human intervention, offers continuous unattended operation of sensors which analyze a flowing sample stream. Samples are continuously collected and analyzed, and immediate results are available.

Requirements by the EPA for potable water specifications can be met by currently used methods and equipment. But when a large number of samples must be collected and analyzed, manpower requirements make these manual operations expensive.

Samples often are sent to distant labs for periodic testing, but they may change composition in transit (for example, volatiles may be substantially lower). Results of these analyses may not be known for several weeks.

NASA's automated system consists of a computer and a number of instruments designed to sense the presence of bacteria. Operational instruments include: an automated twin-column gas chromatograph, developed at NASA's Ames Research Center, Mountain View, Calif., based on the Viking lander chromatograph which was designed to detect life on Mars; an automated coliform sensor, developed by Boeing Co., Houston; and an automated biomass detector, built by Boeing based on research at NASA's Goddard Space Flight Center, Greenbelt, Md. A viral detector, developed at Ames, is being evaluated and technology for a heavy metal sensor is being developed. These instruments will be added at a later date.

The project has three goals: to demonstrate the feasibility of automated water-quality monitoring; to identify key water-quality sensors; and to evaluate the cost effectiveness of water treatment.

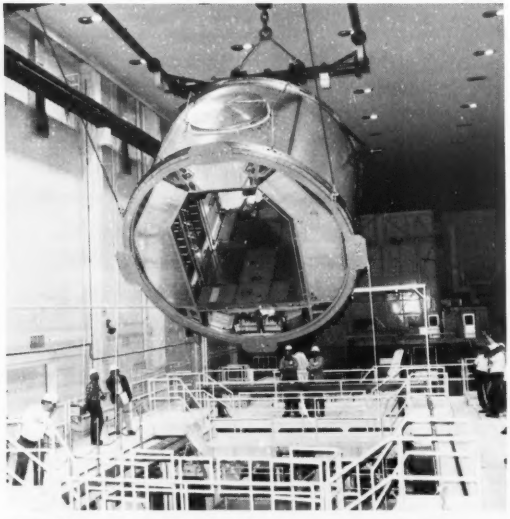
Twelve water-quality characteristics are measured by the system, including ammonia, chlorides, coliform, halocarbons, sodium, temperatures, pH and hardness.

The project began in 1974 at NASA's Johnson Space Center, Houston, when NASA, HUD and the EPA set out to plan the total use of waste products from a large apartment complex or small city. Glass and metals were to be recycled, paper waste was to be burned for heat and hot water, and waste water was to be purified and reused.

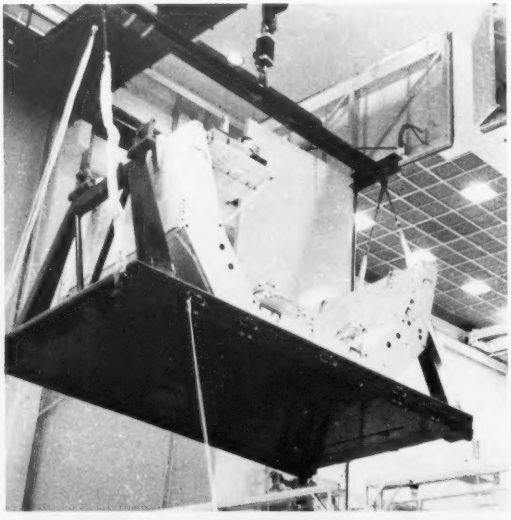
A panel of experts determined the biological, chemical and physical qualities which would have to be measured for purification of waste water.

Design and assembly of the automated water-quality monitoring system to meet these parameters was completed at the Johnson Space Center. The system was tested in Houston's Southwest Waste Water Treatment Facility.

When Santa Clara Valley Water District officials heard about the system, they asked to have it transferred to the experimental water reclamation plant in Palo Alto. When the unit was installed in Palo Alto in 1977, management was transferred to Ames Research Center.



**Spacelab Accommodations**—The living quarters of the Spacelab engineering mockup is hoisted and put into place in Kennedy Space Center's Operations and Checkout Building. Spacelab is one of the many payloads to be transported to Earth orbit inside the Space Shuttle's cargo bay. Spacelab is a reusable space laboratory built by the European Space Agency and will enable scientists to conduct experiments in a shirt-sleeve environment is a pressurized cabin in space.



**Shuttle First Payload**—The first payload to be carried into space by the Space Shuttle, OSTA-1, is lowered into the Cargo Integration Test Equipment stand in the Operations and Checkout Building at Kennedy Space Center, Fla. The CITE stand simulates the orbiter's cargo bay for testing interfaces between the experiments, mounted to a pallet and the vehicle. OSTA-1 will carry experiments devoted to earth resources applications. The payload will fly on the second Space Shuttle mission, scheduled for August.

## NASA Engineers Developing Advanced Cooling System

NASA engineers at the Goddard Space Flight Center, Greenbelt, Md., are developing a refrigeration system for space operations that also could lead to commercial development of pumps, motors, compressors and other mechanical devices which would operate virtually without wear.

The new development, a significant technological advancement, eliminates the friction and therefore the wear associated with moving parts. The piston and

**SINGLE EXPANSION CRYOGENIC COOLER WITH LINEAR MAGNETIC SUSPENSION**

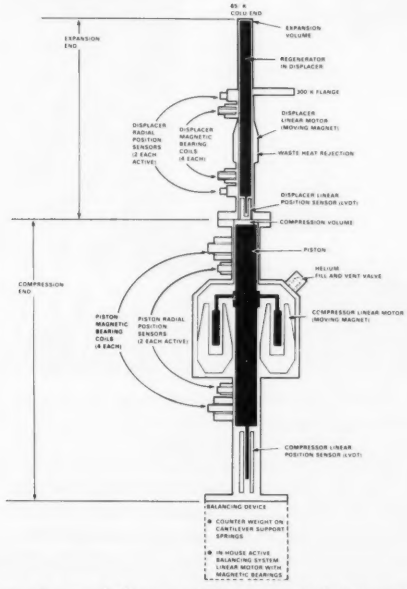



Diagram of a revolutionary cooling system being developed by scientists at NASA's Goddard Space Flight Center, Greenbelt, Md. The new system represents a technological breakthrough that could lead to the commercial production of pumps, motors, compressors and other mechanical devices which would operate virtually without mechanical wear.

displacer in the NASA cooling system are suspended in a magnetic field, permitting the parts to move without touching the side of their housing—therefore no friction is incurred.

The development could increase system lifetime for operation of astronomical and Earth-watching instruments in space by as much as six times—from the present six to 10 months up to three to five years, according to the Goddard engineers.

The engineers have been working on the project for about two years and expect to deliver the first model for testing in April, according to Allan Sherman, Head of the Cryogenics, Propulsion and Fluid Systems Branch in Goddard's Engineering Directorate. The system is being fabricated at the Philips Laboratory in Briarcliff Manor, N.Y. Working with Sherman on the project are Max Gasser and Philip Studer.

There are a number of mechanical refrigeration systems being developed for space operations, but all have mechanical linkages, complicated designs, or use bearings and seals which do not have a long lifetime, according to Sherman.

The new system, a Stirling cycle cooler, uses helium gas to develop refrigeration, features two linear motors, one for compression and one for expansion, and two sets of magnetic bearings. The bearings employ four electromagnets surrounding the piston and displacer chambers, continually adjusting the magnetic fields via an electronic controller. The electronic controller assures that the linear motors drive the piston in the compression stage and the displacer in the expansion section with the proper phase relationship.

Previously, most spacecraft instruments did not require significant cooling systems. As those instruments, such as gamma and infrared types, have become more sophisticated, improved cooling systems have become necessary. The new system will provide a much higher capacity for cooling, according to the engineers.

## Selection Begun In Shuttle Student Project Competition

Selection of 200 semifinalists has begun for the first national Space Shuttle Student Involvement Project, a joint effort of NASA and the National Science Teachers Association.

The objective of the project is to stimulate the study of science and technology in grades 9 through 12 by engaging students in a competition to develop payload experiments suitable for flight aboard the Space Shuttle. The contract to conduct this competition and select the winners was awarded last summer by NASA to the National Science Teachers Association, with headquarters in Washington, D.C.

Since announcement of the competition in August, the National Science Teachers Association has

received more than 70,000 requests for contest materials.

Interested students first submitted experiment proposals to their high school science teacher for review and screening for adherence to the rules of the competition. Teachers submitted all eligible projects to the National Science Teachers Association for consideration.

By Feb. 2, the Association had received 1,500 entries in the competition. These proposals were grouped into 10 geographic areas or regions determined by the Association.

Interdisciplinary teams of teachers, scientists and engineers, selected by the National Science Teachers Association, were established to review these proposals at the 10 regional levels. Twenty students from each of the regions will be selected for the semifinals of the competition.

These semifinalists and their teachers will attend 10 regional Space Shuttle conferences to present their proposed experiments to other students, NASA representatives and industry scientists. These conferences will be held in March and April principally at NASA field centers.

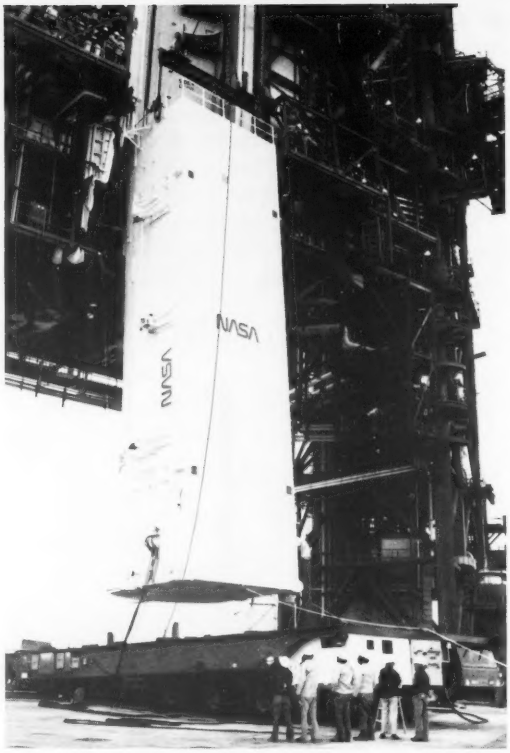
From the 200 semifinalists, 10 projects will be selected on the basis of scientific or engineering merit for potential flight aboard the Space Shuttle. These 10 national winners and their teachers will attend a special educational conference at NASA's Kennedy Space Center, Fla., late this summer. All competition entrants will receive a certificate of participation.

To broaden participation in the program, NASA is encouraging U.S. industrial firms and other non-NASA groups to sponsor student winners and assist them in developing their experiments for flight and post-flight analysis and reporting.

The Space Shuttle *Columbia,* the world's first reusable spacecraft, is scheduled for its first manned orbital flight no earlier than the week of April 5.

Winning National Science Teachers Association student experiments will be assigned to specific Shuttle flights as the experiments are ready, as Shuttle payload space is available and as future Shuttle flights are confirmed.

A second Space Shuttle Student Involvement Project contest will open in September with that series of regional conferences to be held in March 1982. Selection of new groups of student winners will be made in May 1982. NASA's current plans are to increase the number of student winners for this competition from 10 to 20 finalists.




**Moving Vertical Payloads**—Vertically processed Space Shuttle cargos will be transported to Kennedy Space Center's launch pad in this payload canister for installation into the Shuttle orbiter. Outfitted with dummy payloads, the canister is being hoisted up to the Rotating Service Structure at Kennedy's launch Complex 39, Pad A, to undergo a series of tests to verify payload transfer procedures at the pad. The 69 x 21 foot canister is moved between Kennedy's payload processing facilities by the 48-wheeled transporter.

## Goddard Hosts Solar Flare Workshop

NASA's Goddard Space Flight center was host to a scientific workshop on how solar flares originate from Feb. 17 to 20.

The four-day meeting brought together scientists from around the world who have participated in flare buildup studies in conjunction with experiments aboard NASA's Solar Maximum Mission spacecraft and other satellites and ground observatories.

Solar Max, launched from Cape Canaveral, Fla.,

on Feb. 14, 1980, is in a 500-kilometer-high equatorial orbit of the Earth and was designed to make the most comprehensive observations ever made of solar flares.

After nine months of successful operation, three fuses aboard Solar Max associated with the altitude control and pointing system failed. As a result, three experiments which required fine pointing control have been placed on standby. One experiment, the coronograph/polarimeter, has failed. Three other experiments are currently returning data to Goddard.

Dr. Zdenek Svestka, Space Research Laboratory, Utrecht, The Netherlands, directed the meeting. Scientific review and analysis of information developed from the flare buildup studies by participating investigators was the principal topic. Featured was a report on Soviet ground observatories by Dr. David M. Rust, coordinator for the Solar Maximum Year.

## Contractor News

**General Dynamics Corp.,** Convair Div., San Diego, Calif., has been awarded two contracts by NASA's Lewis Research Center, Cleveland, in support of the Atlas Centaur launch vehicles program. One contract in the amount of $12,685,213 was awarded for management and engineering services; a $16,506,229 contract was awarded for launch operations and test support services through Dec. 31, 1981. Both of these contracts are cost-plus-award-fee contracts and are continuations of work performed under earlier contracts with Convair. The management and engineering support activities will be carried out principally at the Convair plant in San Diego and also at the Eastern Space and Missile Center, Fla. Launch operations and test support activities will be carried out at the Eastern Space and Missile Center.

**Sigma Data Services Corporation,** Silver Spring, Md., has been selected to negotiate a $4.3 million non-personal services contract to operate the National Space Science Data Center at the Goddard Space Flight Center, Greenbelt, Md. The cost-plus-award-fee contract calls for an initial 2 year agreement with three 1-year soft option extensions. All work, will be performed at the Goddard Center which archives and distributes data throughout the world from scientific and applications spacecraft.

NASA's John F. Kennedy Space Center, Fla., has awarded a $1,298,834 contract to a joint venture made up of three Central Florida firms, for the manufacture of 19 hypergolic control and checkout panels. Each company will fulfill an aspect of the contract. **Precision Fabrication and Cleaning,** Sharpes, Fla., will fabricate and clean the panels; **Olson Electric Co.,** Daytona Beach. Fla., will do the electrical work and **Specialty Maintenance and Construction,** Lakeland, Fla., will supply materials and make frames for the panels. The hypergolic panels will be used at Vandenberg Air Force Base in California, to service the in-orbit propulsion systems of the Space Shuttle. Hypergolic propellants ignite upon contact and are used for the orbiter's secondary propulsion and attitude control systems. The hypergol control and checkout panels will be used to drain and clean the hypergol modules during ground servicing. The contract calls for the work to be completed in one year.

**Engineering Incorporated,** Hampton, Va., has been selected by NASA's Langley Research Center for negotiation of a contract to design and fabricate research equipment in support of Langley's staff. The cost-plus-fixed-fee contract will cover a period of three years, beginning about March 1, with a two-year unpriced option. The value of the contract work is approximately $3.18 million. The work will include design of machinery elements; mechanical structres; heat transfer devices; and fluid, mechanical and electrical systems for specialized research equipment. All work, including fabrication and assembly, will be done at the contractor's facility or at NASA-Langley.

**IBM Corporation,** Federal Systems Division, Cape Canaveral, Fla., has been awarded a contract modification valued at $3,601,000 by NASA's John F. Kennedy Space Center, for additional system engineering and software development services in support of Space Shuttle checkout and launch systems at Kennedy and at Vandenberg Air Force Base, Calif. Computer systems are used to automatically control and perform much of the Shuttle vehicle checkout while the vehicle components are being prepared for launch. The systems also provide the capability for work order control and scheduling and will conduct countdown and launch operations. This action brings the estimated cumulative value of the original cost-plus-award fee contract to $56,098,759. The additional efforts cover the period from June 4, 1980 through Sept. 30, 1981.

# Did You Know?

**NASA's Marshall Space Flight Center,** Huntsville, Ala., set a new safety record last year with the completion of more than four-and-a-half million man-hours worked since April without a lost-time injury. The Marshall Safety Office began 1980 with a campaign to make that year the safest in the center's history. An intermediate goal was to accrue two million man-hours without a lost-time injury. That goal was attained in August 1980. In October, with slightly over three million man-hours without a lost-time injury, additional goals were set. The two additional objectives were: extending the number of man-hours without a lost-time injury to the maximum possible and maintaining or bettering the lost-time frequency rate. The frequency rate is the number of disabling (lost-time) injuries per 200,000 man-hours worked. A disabling injury is one which prevents the employee from returning to work the following day. With more than 6.6 million man-hours worked, Marshall incurred only two lost-time injuries. Both of these injuries were what safety officials call unavoidable falls, the first one occurring in January and the second in April 1980. This gave Marshall a frequency rate of only 0.06, an improvement of more than 700 percent over the frequency rate of 1979's 0.42.

A **Langley Research Center** manager has been chosen as NASA's representative in the Harvard University Program for Senior Executive Fellows. James L. Raper, Assistant Head of the Experiment Analysis Branch, Atmospheric Environmetnal Sciences Division, won NASA's endorsement to participate in the executive education program of Harvard's John F. Kennedy School of Government, following an agency-wide competition. He began the 13-week course on Feb. 7.

The Program for Senior Executive Fellows, developed by Harvard after the passage of the Civil Service Reform Act of 1978 and the subsequent creation of the Senior Executive Service, is an intensive course for those in the federal government who are preparing for, or have recently assumed, positions of significant managerial responsibility. It was first offered in September 1980.

**NASA's Lewis Research Center** has developed a new mathematical model that has improved execution time ninefold in a computer program which controls an aircraft flight simulator. For the first time this program will allow the simulator to give real-time responses to pilot input on a new type of jet-powered V/STOL aircraft. Piloted simulators are used widely in the development of new aircraft and for pilot training. They not only provide the visual illusion of flight by means of television screens but they also create the illusion of the motion of flight because the cab of the simulator moves in space to duplicate as closely as possible the motions of a real aircraft. One of the world's most advanced piloted simulator facilities is located at NASA's Ames Research Center, Mountain View, Calif., and is called the Flight Simulator for Advanced Aircraft.

**Idea Clearinghouse** this month cites NASA Headquarters Information Systems Division for applying recent microfiche technology (Bell and Howell Microx System II) to the records management needs of the Office of Space Transportation Operations. This office maintains Shuttle launch service agreements and payload integration plans from many different research institutions and countries. This creates a multitude of individual files that are frequently referenced, copied and updated.

With a Bell and Howell Microx System II, it takes no special operating skills to produce microfiche right in the office. The Microx System II is an instant imaging system that produces an erasable/updatable record using a dry photoplastic film. With this push-button technology an operator can reproduce or update a record in seconds.

Microfiche has the advantage of saving office space. You can record 6,000 document sheets on a stack of film about one inch tall, and increase efficiency in storage and retrieval of files. If you want to learn more about the application of this system to your records management program call Eugene Pucine, NASA Headquarters Micrographics Manager, at FTS 755-3136.

## Expendable Launches for 1981

| Name | Launch Date | Vehicle | Range | Mission Remarks |
|---|---|---|---|---|
| COMSTAR-D | February 21 | Atlas Centaur | ESMC | Comsat General Corp. communications. Reimbursable. |
| Intelsat V-B | April | Atlas Centaur | ESMC | Intelsat communications. Reimbursable. |
| GOES-E | April | Delta | ESMC | NOAA weather. Reimbursable. |
| Navy 20 (NOVA 1) | April | Scout | WSMC | DOD transit. Reimbursable. |
| SBS-B | April | Delta | ESMC | SBS communications. Reimbursable. |
| NOAA-C | May | Atlas-F | WSMC | NOAA weather. Reimbursable. |
| Intelsat V-C | June | Atlas Centaur | ESMC | Intelsat communications. Reimbursable. |
| RCA-D | June | Delta | ESMC | RCA communications. Reimbursable. |
| FLTSATCOM-E | June | Atlas Centaur | ESMC | DOD communications. Reimbursable. |
| Dynamic Explorer | July | Delta | ESMC | NASA scientific. |
| Navy 21 (NOVA 2) | September | Scout | WSMC | DOD transit. Reimbursable. |
| Intelsat V-D | September | Atlas Centaur | ESMC | Intelsat communications. Reimbursable. |
| Solar Mesospheric Explorer | September | Delta | WSMC | NASA scientific. |
| RCA-C1 | October | Delta | ESMC | RCA communications. Reimbursable. |
| NOAA-D | November | Atlas-F | WSMC | NOAA weather. Reimbursable. |
| Intelsat V-E | December | Atlas Centaur | ESMC | Intelsat communications. Reimbursable. |

## Space Shuttle Launches for 1981

| Orbiter | Launch Date | Launch site | Payload |
|---|---|---|---|
| OV-102 | April | KSC | |
| OV-102 | August | KSC | OSTA-1<br>DFI (with IECM) |
| OV-102 | December | KSC | PFTA<br>DFI (with IECM) |

## Patents for Inventions from NASA Research

*The office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.*

| Inventor(s) and Employer | Title | Patent No. | Installation |
|---|---|---|---|
| Frank Byrne, NASA/KSC | Common data buffer system | 4,254,464 | KSC |
| Michael J. Kavaya, Caltech/JPL Pasadena | Stark effect spectrophone for continuous absorption spectra monitoring | 4,253,769 | NRO/JPL |
| John M. Franke, NASA/LaRC | Direction sensitive laser velocimeter | 4,255.048 | LaRC |
| Curtis R. Helms, Harold M. Smyly NASA/MSFC | Prosthetic urinary sphincter | 4,256,093 | MSFC |
| Allan R. McDougal, Caltech/JPL Pasadena | Hot gas engine with dual crankshaft | 4,255,929 | NRO/JPL |
| Kenneth A. Green, Microwave Research Corp., North Andover, Mass. | Multifrequency broadband polarized horn antenna | 4,258,366 | NRO/JPL |

# Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

## Property Measurement

The van pictured is used by Land Inventory Systems, Inc., Newport, N.H., to measure and map property for tax assessment purposes. A state law requires that all New Hampshire towns have tax maps and communities are looking for the most accurate property measurements attainable in order to maximize tax revenue. Specially designed to meet that need, Land Inventory's van employs technology adapted from the navigation system of the Lunar Rover, the wheeled vehicle in which moon-exploring astronauts traveled as much as 20 miles from their Lunar Module base.

The astronauts had to know their precise position relative to the Lunar Module at all times, so that in case of emergency they could take the shortest route back. The Lunar Rover's computerized navigation system kept a highly accurate record of the directional path and the distance traveled from the Lunar Module, thus providing a continuous position report. The distance measuring subsystem was a sophisticated and far more accurate counterpart of the odometer on an automobile, which counts the revolutions of the wheels. Encoders on a wheel of the Lunar Rover generated electrical pulses for each fractional revolution and the computer analyzed the pulses to determine the distance traveled in a given direction.

The distance measuring technique is the portion of the Lunar Rover navigation system adapted to property measurement.* Land Inventory's van has encoding equipment on the left rear wheel (see photo). The encoders generate 180 pulses for each revolution of the wheel and a computer inside the van translates the pulse data into distance traveled with an accuracy of one-half inch in 500 feet.

* **Note:** NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs but it does encourage the widest possible use of its technology.

*For the benefit of all . . .*

NASA
National Aeronautics and Space Administration